

DATE: November 9, 2006

TO: Office of Drinking Water Technical Staff

THROUGH: J. Wesley Kleene, Ph.D., P.E., Director, Office of Drinking Water

FROM: Susan E. Douglas, P.E., Field Services Engineer

SUBJECT: System Evaluation, Design & Construction - MIOX Mixed Oxidant Treatment Systems

RELATED: WM 841(Interim Guidance on Waterworks Classification)

SUMMARY STATEMENT

Disinfection by on-site generation of “mixed oxidants” using the proprietary MIOX Corporation treatment process is an option for waterworks to meet the disinfection requirements in 12VAC5-590-500 of the *Regulations*. This memo addresses the process design features and controls, approval procedures, waterworks classification, monitoring and reporting requirements for these systems.

I. BACKGROUND

The MIOX On-Site Mixed-Oxidant Generation System produces a chlorine-based disinfectant solution using a proprietary electrolytic cell. The cell generates the disinfectant from a sodium chloride salt solution, eliminating the transport of chlorine gas or hypochlorite solution to the site. Another purported advantage of using the mixed oxidant system over a conventional hypochlorite feed system is the elimination of biofilm on pipes and membranes. Removal of the biofilm on piping results in lower chlorine demand / dosage, a more durable free chlorine residual in the distribution system, and reduction in distribution system TTHM levels.

The MIOX mixed oxidant onsite generators have been certified under ANSI / NSF Standard 61, Drinking Water Components – Health Effects.

EPA has determined that waterworks using MIOX generators will have the same monitoring requirements as other chlorine systems under the Stage 1 Disinfection Byproduct Rule. This in effect eliminates the earlier concern for disinfection byproducts or residuals that are produced by ozone and chlorine dioxide systems. EPA has also stated that inactivation credit under the Surface Water Treatment Rules for MIOX systems will be determined based on chlorine CT tables.¹ We can infer from this decision that the MIOX “mixed oxidants generator” should be considered to be solely a hypochlorite generator, and the “mixed oxidants” (such as ozone, chlorine dioxide) produced by the equipment are negligible.

¹ Memo from EPA Director Ephraim King to EPA Region 1-10 Water Division Directors, dated July 18, 2001.

MIOX mixed-oxidant systems may be used to provide disinfection at wells and surface water treatment plants, distribution booster pump stations, and as a pre-oxidant for iron, manganese, hydrogen sulfide, and taste and odor control.

II. DESIGN FEATURES

A. General Description

MIOX on-site mixed-oxidant generators are automated, and available in different configurations and capacities. Components typically include a brine tank, ion exchange water softener, automated control unit, oxidant solution tank, booster pump(s), flow meter, and solution inductor. Items which may need to be added include a pre-filter (for particulate removal in groundwater well applications), power converter, and electronic interface for remote monitoring and alarms. A typical installation schematic and elevation view are included at the end of this memo.

B. Design Elements

Since the MIOX mixed-oxidant generator is a proprietary product, the manufacturer (MIOX Corporation) will advise on the appropriate generator model selection and sizing of major components. However, the existing conditions and operational requirements of the equipment, which form the basis for the manufacturer's recommendations, and integration of the equipment into the waterworks must be verified by ODW. These include, but are not limited to:

- A. Chlorine demand – dose requirements
- B. Hydraulic capacity of individual components, especially injector system:
backpressure, sizing of booster pump(s), flow meter, venturi inductor
- C. Tank overflows and drains
- D. Controls

C. Standby Chlorination Equipment

12 VAC 5-590-1000 C. of the *Regulations* requires the provision of standby equipment capable of meeting the required disinfection dosage. This may be accomplished by:

- 1. Duplicate generators or the ability to feed liquid hypochlorite in the solution tank or other spare tank (the size of the tank will need to be checked to verify that the supply will be adequate)
- 2. Duplicate booster pumps, if used
- 3. Spare solution metering pump

III. APPROVAL PROCEDURES

- A. A Preliminary Engineering Conference is required.
- B. Submission of plans and specifications, issuance of a Construction Permit, receipt of the engineer's Statement of Completion, and final inspection by ODW will follow standard procedures.
- C. A Temporary Operation Permit will be issued with process monitoring requirements incorporated into the permit as Special Permit Requirements, per WM 885. The temporary permit duration will be 12 months, after which time a Standard Operation Permit will be issued. The required monitoring is itemized in Section V of this memo.

IV. WATERWORKS CLASSIFICATION & OPERATOR REQUIREMENTS

Waterworks employing the MIOX process will be designated as a minimum Class VI. (The waterworks may be further restricted to a Class V through I depending on its size and use of other treatment technologies. Refer to WM 841 for further information.)

A minimum Operator Class VI will be required.

V. MONITORING AND REPORTING

A. Start Up Considerations

The use of mixed oxidants has been reported to cause elimination of biofilm on pipes. Sloughing of existing biomass should therefore be considered in the initial phase of operation. Persistent/aggressive flushing may be warranted, for a period of at least 3 months. The length of time will depend on the age and extent of the water distribution piping.

B. Temporary Operation Permit – Monitoring and reporting requirements identified below are in addition to any standard monitoring required per 12 VAC 5-590-370 and 530 of the *Regulations*. Operational records to be itemized as Special Permit Requirements include:

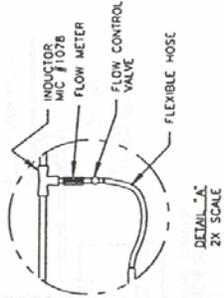
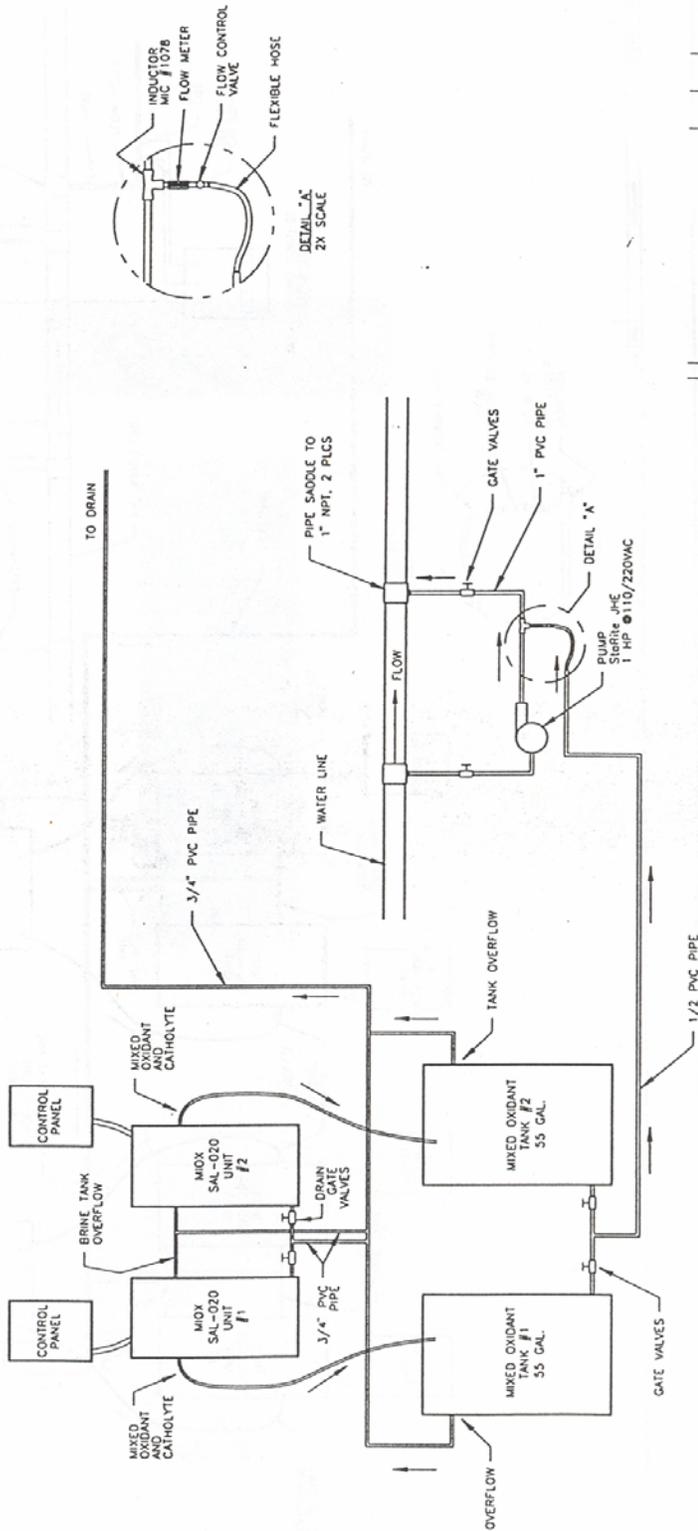
1. Free and total chlorine residual, collected downstream of the solution injection point, at a minimum frequency of twice/week.
2. Free and total chlorine residual, collected in the distribution system at locations representative of average and maximum residence time, at a minimum frequency of twice/week.
3. Quantity of salt added.
4. Oxidant dosage delivered, measured as total chlorine.
5. Distribution pipe flushing activities – location, duration, dates - along with chlorine residual measurements before and after.

C. Standard Operation Permit - The Monthly Operation Reports *must* include operational record items 1 and 3 required for the Temporary Operation Permit. It is preferable to continue all the temporary permit reporting requirements after the Standard Operation permit is issued.

IV. REFERENCES

Information on MIOX treatment equipment is available on their website at www.miox.com

TYPICAL SCHEMATIC
MIOX Dual "SAL" SYSTEM
(Disregard model number)



0	ORIGINAL ISSUE	1/27/75	TRKLM	BR	008	MS
<p>See explanation for this drawing in other sheets of this drawing. This drawing is a typical schematic of a MIOX Dual "SAL" SYSTEM. It is not intended for use as a construction drawing. It is intended for use as a reference drawing only.</p>						
<p style="text-align: center;">MIOX Corporation</p> <p style="text-align: center;">1000 West Park Ave., Columbus, Ohio 43260</p>						
<p style="text-align: center;">GENERAL SCHEMATIC OF A TYPICAL SAL SYSTEM</p>						

TYPICAL ELEVATION
MIOX Single "SAL" SYSTEM
(Disregard model number)

